Patent Claims

Claim 1

An irrigation system for medical care comprising

(a) a plurality of pressurisable reservoirs containing prescribed irrigation fluid;

(b) fluid conduction means for leading the said fluid through selectively from the said reservoir to a first prescribed position;

(c) a first pressure source to control pressure in a first reservoir which is one of the said reservoirs, by communicating through to the said reservoir;

(d) a second pressure source to control pressure in a second reservoir which is one of the said reservoirs, by communicating through to the said reservoir;

(e) a regulation means, which in cooperation with the first and second pressure source, pressurizes the first and second pressurisable reservoirs independently;

to selectively and correspondingly pressurize the fluid in said reservoirs.

Claim 2

An irrigation system for medical care of Claim 1 characterised in that the aforesaid pressurisable reservoir is enclosed.

Claim 3

An irrigation system for medical care of Claim 1 characterised in that the aforesaid first and second reservoirs are not connected and are separate.

Claim 4

An irrigation system for medical care of Claim 1 characterised in that the aforesaid first and second pressure source are connected to single pressure pump.

Claim 5

An irrigation system for medical care of Claim 1 characterised in that the fluid in the said first reservoir is identical to the fluid in the said second reservoir.

Claim 6

An irrigation system for medical care of Claim 1 characterised in that the aforesaid fluids from the said reservoirs are simultaneously lead through to the first prescribed position.

Claim 7

An irrigation system for medical care of Claim 1 characterised in that the aforesaid fluids from the said reservoirs are sequentially lead through to the first prescribed position.

Claim 8

An irrigation system for medical care of Claim 1 characterised in that the said regulation means includes a regulation panel containing a display that indicates the pressure in each reservoir.

Claim 9

An irrigation system for medical care of Claim 1 characterised in that it further includes, in combination, a self-contained power supply which supplies activation power from battery.

Claim 10

An irrigation system for medical care comprising

(a) a plurality of enclosed flexible reservoirs containing prescribed liquid for medical care;

(b) fluid conduction means for leading the said fluid through selectively from the said reservoirs to a first prescribed position;

(c) a first air bladder to control pressure in a first reservoir which is one of the said reservoirs, by communicating as a pressure through to the said reservoir;

(d) a second air bladder to control pressure in a second reservoir which is one of the said reservoirs, by communicating as a pressure to the said reservoir;

(e) a means connected to the first and second air bladders, in order to pressurize the first and second air bladders independently;

to selectively and correspondingly pressurize the said fluid.

Claim 11

An irrigation system for medical care of Claim 10 characterised in that furthermore, a pair of pressure pump valves are included which are individually mutually connected with the said first and second air bladders, to have the effect that when they are activated so that the pressure should be released from said air bladders selectively, independently and rapidly.

Claim 12

An irrigation system for medical care of Claim 10 characterised in that

(a) alarm means; and

(b) the pressure detection means which responds to accidental pressure release of one of said reservoirs, in order to activate said alarm means;
are also provided.

Claim 13

An irrigation system for medical care of Claim 10 characterised in that means to provide and maintain a fixed pressure in said reservoirs is also included.

Claim 14

An irrigation system for medical care of Claim 11 characterised in that
(a) alarm means; and
(b) the pressure detection means which responds to accidental pressure release of one of said reservoirs, in order to activate said alarm means;
are also provided.

Claim 15

An irrigation system for medical care of Claim 12 characterised in that means to provide and maintain a fixed pressure in said reservoirs is also included.

Claim 16

An irrigation system for medical care of Claim 12 characterised in that it also includes means which, in order to activate said alarm means, respond to accidental cessation of flow of liquid for medical care.

Claim 17

An irrigation system for medical care characterised in that it provides
(a) a plurality of enclosed flexible reservoirs containing prescribed liquid for medical care;
(b) fluid conduction means for leading the said liquid for medical care through selectively from the said reservoirs to a first prescribed position;
(c) a first air bladder to control pressure in a first reservoir which is one of the said reservoirs, by communicating through to the said reservoir in a pressure conduction state;
(d) a first pressure release means connected to the said first air bladder, to release the pressure from the said first air bladder rapidly;
(e) a second air bladder to control pressure in a second reservoir which is one of the said reservoirs, by communicating through to the said reservoir in a pressure communicating state;

(f) a second pressure release means connected to the said second air bladder, to release the pressure from the said second air bladder rapidly;
(g) means connected to said first and second air bladders which standardly pressurizes said first and second air bladders in order to selectively and correspondingly pressurize said liquids;
(h) means to provide and maintain a fixed pressure in each reservoir;
(i) alarm means; and
(j) the pressure detection means which responds to accidental pressure release inside one of said reservoirs, in order to activate said alarm means;
(k) fluid detection means which, in order to activate said alarm means, respond to accidental cessation of flow of liquid for medical care.

Detailed Description of the Invention

(0001)

Technical Sphere of the Invention

This invention relates to the following, namely, irrigation system for medical care, particularly a continuously controllable system for the flow of irrigation liquid from a plurality of reservoirs.

(0002)

Technology of the Prior Art

In the medical field, there are cases in which irrigation of wound, amputation or other physical opening is required or is highly desirable, but many problems arise. Often, the required quantity of irrigation fluid exceeds the volume of conventionally used fluid source, such as 1-litre container or the like. Moreover, it is often necessary or highly desirable to maintain irrigation state without altering the flow rate of fluid.

(0003)

In past, moreover, in order to achieve a continuous uninterrupted flow of the fluid, it has been proposed to expand the effective reservoir by providing piping from a common or central fluid source and the like. However, this causes other problems such as limitation of the kind of irrigation that can be used, or increase of vulnerability with respect to contamination. In the state in which the total amount of fluid is small, it can be executed just by regulating with respect to the container which supplies such small amounts. Example of such regulation which supplies for non-irrigation is disclosed in US Patent 4,657,160 specification published April 14, 1987 by Andy Woods and Peter Giannini. In the said specification, a pressure infusion system is disclosed in which a flexible bag

containing a fixed quantity of liquid to be infused is enclosed by a pressure band for forcibly forwarding the liquid from the said bag. However, when contents of flexible bag were exhausted, the bag needs to be replaced with a separate bag, and accordingly a temporary interruption of flow is caused. Accordingly, a system suitable for use with a plurality of fluid sources, providing the selectable flow that is continuously controlled is still required.

(0004)

Problems to be Overcome by this Invention

The object of this invention is to improve irrigation system for medical care.

(0005)

Another object of this invention is to put forward continuous flow of irrigation fluid from a plurality of reservoirs.

(0006)

Another object of this invention is to promote the use of irrigation fluids from a plurality of reservoirs.

(0007)

A further object of this invention is to promote the use and adjustment of irrigation fluid controller.

(0008)

Another object of this invention is to produce a fluid controller simply, and to reduce the cost.

(0009)

Means to Overcome these Problems

In accordance with this invention, (a) a plurality of pressurisable reservoirs containing a prescribed irrigation fluid; (b) fluid conduction means for leading the said fluid through selectively from the said reservoir to a first prescribed position;

(c) a first pressure source to control pressure in a first reservoir which is one of the said reservoirs, by communicating through to the said reservoir;

(d) a second pressure source to control pressure in a second reservoir which is one of the said reservoirs, by communicating through to the said reservoir;

(e) a regulation means, which in cooperation with the first and second pressure source, pressurizes the first and second pressurisable reservoirs independently; is provided, to selectively and correspondingly pressurize the fluid in said reservoirs.

(0010)

In accordance with this invention, it may be manipulated so as to selectively and controllably pressurise a plurality of liquid reservoirs individually, and in this way, by developing an improved control system, in which the fluid flow can be continuously controlled even when the liquid reservoir is refilled or replaced, and a continuous flow of fluid from a plurality of reservoirs is given.

(0011)

Moreover, it may be provided with pressure and flow rate alarm, pressure indicator and quick pressure open valve.

(0012)

Accordingly, one distinctive feature of this invention is to provide an easily controllable pressure source at low price for individually pressurising a plurality of separate, flexible-walled pressurisable reservoirs which are respectively fitted with pressure bands in a physically linked condition.

(0013)

A separate distinctive feature of this invention, is to put forward a simple system wherein a common pressure source is used, having air as the source.

(0014)

Yet another separate distinctive feature of this invention, is that a pair of fluid flow and pressure vent (a dump) controllers are established on each pressure reservoir, which impart simple regulation of individual fluid flow, rapid switching and/or emergency cut-off.

(0015)

Moreover, a separate distinctive feature of this invention, is to equip with device for establishing and maintaining a specified pressure level and/or fluid flow rate in a separate embodiment, which contributes to the efficiency of the apparatus.

(0016)

Yet another separate distinctive feature of this invention in a separate embodiment, is to equip with device for detection and control via the use of a sensor.

(0017)

Preferred form for carrying out the invention.

Hereinafter, this invention will be described in further detail while referring to attached figures, however, this invention is not restricted to these.

(0018)

Referring to Figure 1, a general system illustrating basic system elements is shown. Wherein, the power supply which may be conventionally used alternating current power supply 11 or battery 12 is connected to air pump 14 through conventionally used electrical switch 13. Air pump 14 is pneumatically connected through conventionally used tubing 15 to air header 16. Thereafter, air header 16 is connected to air bladder compression assembly body 17a-17d through header extension parts 16a-16d. As will be understood by those skilled in the art, components 11-16 are conventional off-the-shelf components and are readily available through a variety of commercial suppliers.

(0019)

In other words, as shown in Figure 1, the air bladder compression assembly bodies (for example 17a-17d) are each comprised of a pressure bladder, namely a pressurised band 18 in engagement with a flexible irrigation fluid bag 19. When the pressure bladder is inflated, the pressure is communicated to the said flexible irrigation fluid bag 19. Wherein, according to preferred embodiment, the pressure bladders of the air bladder compression assembly bodies 17a-17d are similar to conventional blood pressure band which are generally available from a variety of commercial sources.

(0020)

As described earlier, Figure 3 is a more detailed diagram illustrating a battery powered embodiment of the preferred system according to the invention. It shows that conventional alternating current source 11 is connected to conventional battery charge circuits 20, in accordance with principles well known in the art, and operating electric power is maintained on battery 12. The conduction from battery charge and battery supply circuit is a serially interposed circuit protective device such as a circuit breaker or fuse 21 or the like. From these circuits, conduction is made via path 23 to "push-to-set" pressure level switch 24 and via lead 25 to relay 26. There, it is seen to be connected via path 27 to provide power to several system components as shown in the illustration.

(0021)

Relay 26 is connected via path 28 so as to be under the control of Run Power/Alarm switch assembly 29. Thus, Run Power/Alarm switch assembly 29 acts as a master switch that is used to start and stop system operation. When it is desired to activate the system, a conventional electrical switch S1 in assembly body 29 is actuated to operate relay 26 and to begin system operation.

(0022)

It should be noted that path 23 provides power for switch 24 irrespective of whether or not power switch S1 in switch assembly is on or off, thus providing for activation of conventional display logic 30 so that it may be set for the desired pressure level which is advantageous for the production of air pressure by pump 14. Provision is also made for energization of 3-digit conventional pressure display so that it is powered up and ready to display pressure as soon as main power switch S1 (module 29) is turned on. Moreover, a desired pressure level may be set through conventional pressure level selector 32.

(0023)

It will be observed from reference to Internal Power Distribution Circuit 33 that when relay 26 is closed, provision is made for producing three levels of direct current voltage: (1) +2.5 Volts; (2) +4.1 Volts; and (3) –3 Volts which are represented respectively by arrows 34, 35 and 36. These are applied to various ones of the remaining circuit modules as identified by correspondingly numbered inputs. Thus, turning on of main power switch S1 and closing of relay 26 provides energy at the different voltage levels needed to operate the system.

(0024)

By the way, referring to "Push-to-Set" pressure level switch 24 (the type which switch is pushed, and is set pressure level), it will be seen that it is connected via path 37 to pressure level selector 32. Thus, when it is desired to set the desired level of air pressure in air header 16, a conventional push button in switch module 24 is depressed and the desired level of pressure is selected by manipulation of conventional Pressure Level Selector 32. As the level is being selected, its value is displayed through logic 30 and display 31. When the selected level is accepted by the operator, its value is communicated via path 38 to pressure logic module 40 whence it is effective via path 41 to condition pump control module 42 which in turn is effective via path 43 to control conventional pump 14.

(0025)

Since noise reduction is particularly important in medical environments, provision is made for muffling the sound of air as it enters the pump intake. This is accomplished by muffler which is shown connected to pump 14 by input manifold 45.

(0026)

Returning to Pressure Logic 40, it will be seen that it is additionally controlled by Pressure Detection Circuit Module 46 which is connected to air header 16 via paths 47 and 48. Thus, when the pressure in header 16 is less than the selected value, module 46 communicates to the pressure logic 40 via path 49, thus resulting in pump control 42 to correspondingly condition pump 14.

(0027)

In order to provide for safe operation of the equipment, an over pressure limit switch 50 is provided to sense air header pressure via path 47. If such pressure rises to a predetermined level, then pump control 42 is overridden via path 51 and the pump is instantaneously shut down. At the same time, an alarm signal is conducted via path 52 to visual alarm circuit 53 where it activates a visual alarm and sends a signal via path 54 to activate audio alarm circuit 55 and optional buzzer 56.

(0028)

In addition, an additional level of alarm and control is represented by paths 57 and 58 which interconnect Pressure Logic module 40 with Visual Alarm Circuit module 53 and Pressure Detection Circuit module 46.

(0029)

With further reference to Figure 3, pump air outflow vessel 60 which connects pump 14 to reservoir 61 and conventionally used check valve 62 are found. Air is introduced into vessel 47 through vessel 63 at said check valve 62, and thereafter, it is communicated to air header 16. Thereafter, air header 16 is connected to preferably four outputs 64a-64d, which are in turn connected to four air bladders such as air bladders 17a-17d (Figures 1 and 4) directly or preferably through an air management manifold such as manifold 70 (Figure 4).

(0030)

Provision is optionally but preferably made for inclusion of battery monitoring and display circuits. These are conventional and are represented by items 12a and 12b. Inclusion of a battery condition display on the system display panel adds to the usefulness and dependability of the equipment.

(0031)

By the way, referring to Figure 4, Air Management Manifold 70 which is a module of air paths, valves and connectors is schematically shown. Air input to the manifold is represented by path 47 which in turn is connected to a header corresponding to header 16 (Figures 1 and 3) and including branches 16a-16c connected through T's and an elbow 71a-71d. Extending from these T's and elbows are individual air paths 72a-72d which include serially interposed air valves represented by switch elbows 73a-73d, thus providing for individual control of air passing through paths 72a-72d.

(0032)

From the downstream side of air valve 73a-73d, individual air vessel 74a-74d each leads to separate air bladder compression assembly body 17a-17d. Each of said air bladder compression assembly body 17a-17d includes air pressure bladder, namely a pressure band such as symbol 18 or the like of Figure 2 and flexible fluid bag such as 19 or the like of Figure 2. However, when comparing Figure 1 and Figure 2, there is provided, in Figure 4, a series of individual pressure dump valves 75a-75d, the upstream portions 76a-76d of which are in communication with air in pressure bladders 18a-18d (Figure 2); and the downstream portions 77a-77d being directed to any suitable air dump environment. Generally, the air dump environment is the location in which the equipment is used. However, in certain circumstances it may be desired to vent the air dump to some predetermined location, when a hose or other path may be connected to the air dump terminals.

(0033)

The aforesaid air dump valve 75a-75d is operated by manual operation, and/or may be controlled electrically by using the like of connection to the pressure logic circuits 40 of Figure 3. Well known various kinds of valve can be used.

(0034)

It will now be evident to those skilled in the art that there has been described herein an improved automatic pump and air ballast squeeze system that provides a number of features including provision for individual control of a plurality of flexible bags together

with fluid flow control, ability to change bags without fluid flow interruption, and over/under pressure alarm or shut-down.

(0035)

Wherein, this invention with respect to preferred embodiment was described, it will be evident that other adaptations and modifications can be employed without departing from the spirit and scope thereof. For example, alternatives may be employed for the squeeze bag assemblies.

(0036)

Wherein, the terms and expressions employed herein have been used as terms of description and not of limitation. Accordingly, there is no intent of excluding equivalents, but on the contrary it is intended to cover any and all equivalents that may be employed without departing from the spirit and scope of the invention.

Brief Description of the Figures

Figure 1

Figure 1 is a block diagram illustrating a general system according to the principles of the invention.

Figure 2

Figure 2 is a block diagram illustrating the paired relationship of pressure bladders and flexible fluid bags in accordance with the invention.

Figure 3

Figure 3 a more detailed diagram illustrating the preferred system according to the invention.

Figure 4

Figure 4 is a block diagram illustrating an air management manifold according to the invention.

Key to Symbols

11: alternating current power supply

12: battery

14: air pump

61: reservoir

17a-17d : air bladder compression assembly body,

Figure 1

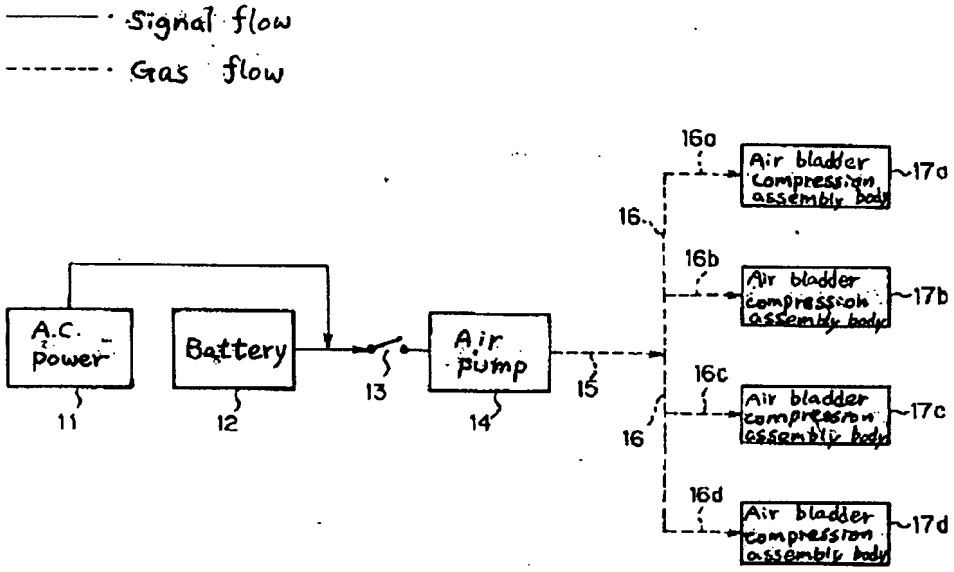


Figure 2

17a-d

Pressure bladder	Flexible fluid bag

18a-18d 19a-19d

Figure 3

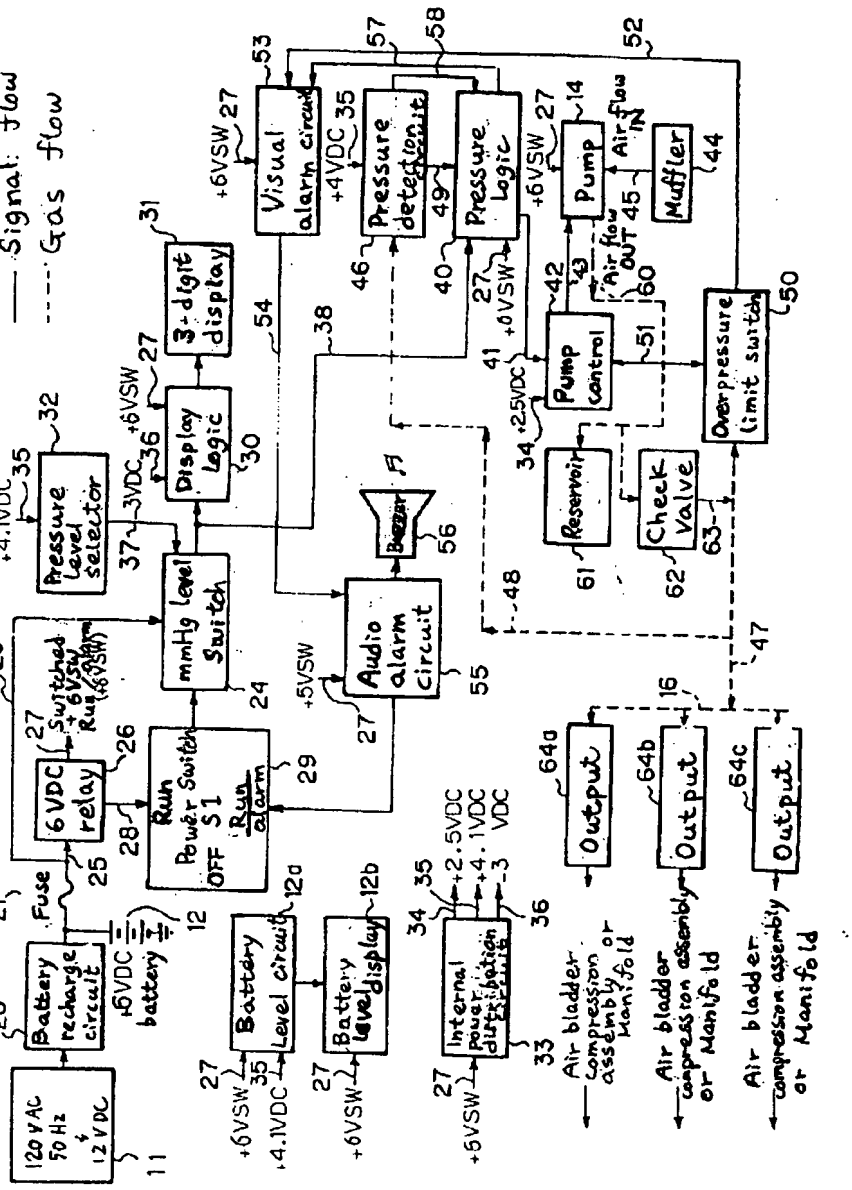
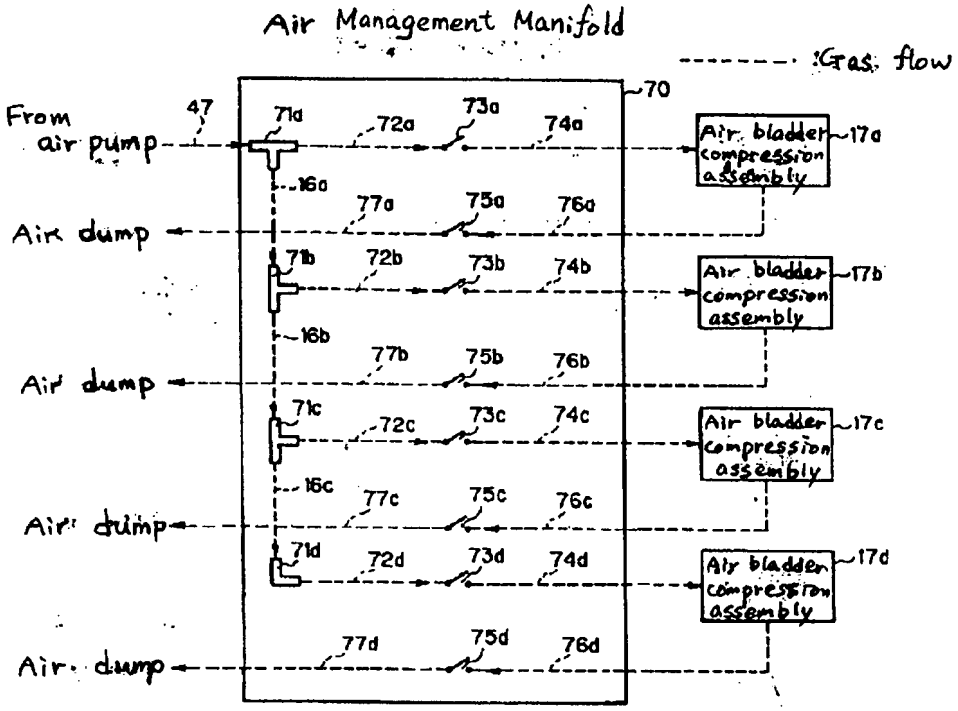

Signal flow
Gas flow
120 VAC 50 Hz or 12 VDC
Battery recharge circuit
6VDC battery
Fuse
6 VDC relay
Switched +6VSW Run (6VSW)
Run Power Switch S1 OFF
Run alarm
mmHg level Switch
Pressure level selector
Display Logic
3 digit display
Visual alarm circuit
Pressure detection circuit
Pressure Logic
Pump
Air flow IN
Muffler
Air flow OUT
Pump control
Overpressure limit switch
Reservoir
Check Valve
Buzzer
Audio alarm circuit
Battery Level circuit
Battery level display
Internal power distribution circuit
Output
Output
Output
Air bladder compression assembly or Manifold
Air bladder compression assembly or Manifold
Air bladder compression assembly or Manifold

Figure 4


Air Management Manifold
Gas flow
From air pump
47
70
71a
72a
73a
74a
Air bladder compression assembly
17a
16a
77a
75a
76a
Air dump
71b
72b
73b
74b
Air bladder compression assembly
17b
16b
77b
75b
76b
Air dump
71c
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Air bladder compression assembly
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76c
Air dump
71d
72d
73d
74d
Air bladder compression assembly
17d
77d
75d
76d
Air dump

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